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3. If A be the area of the circle inscribed in a triangle, A_1, A_2, A_3 the areas of the escribed circle, show that $\frac{1}{\sqrt{A}}=\frac{1}{\sqrt{A_1}}+\frac{1}{\sqrt{A_2}}+\frac{1}{\sqrt{A_3}}$.

[Selected from *Todhunter's Plane Trigonometry.*]

Solution by ROBERT J. ALEY, A. M., Professor of Mathematics in the Indiana State University, Bloomington, Indiana, and J. A. CALDERHEAD, Superintendent of School, Limaville, Ohio.

$r=\frac{S}{s}$, where r=radius of inscribed circle, S=area of triangle, and $s=\frac{1}{2}(a+b+c)$=half the sum of the sides of triangle. (*Todhunter's Plane Trigonometry*, Art. 248.)

Also $r_1=\frac{S}{s-a}$, $r_2=\frac{S}{s-b}$, $r_3=\frac{S}{s-c}$ where r_1, r_2, r_3 respectively, represent the radii of the escribed circles. (Art. 250).

$$\therefore\ A=\frac{\pi S^2}{s^2},\ A_1=\frac{\pi S^2}{(s-a)^2},\ A_2=\frac{\pi S^2}{(s-b)^2},\ A_3=\frac{\pi S^2}{(s-c)^2}.$$

$$\therefore\ \frac{1}{\sqrt{A}}=\frac{s}{S\sqrt{\pi}},\ \frac{1}{\sqrt{A_1}}=\frac{s-a}{S\sqrt{\pi}},\ \frac{1}{\sqrt{A_2}}=\frac{s-b}{S\sqrt{\pi}},\ \frac{1}{\sqrt{A_3}}=\frac{s-c}{S\sqrt{\pi}}.$$

$$\therefore\ \frac{1}{\sqrt{A_1}}+\frac{1}{\sqrt{A_2}}+\frac{1}{\sqrt{A_3}}=\frac{s-a}{S\sqrt{\pi}}+\frac{s-b}{S\sqrt{\pi}}+\frac{s-c}{S\sqrt{\pi}}=\frac{3s-(a+b+c)}{S\sqrt{\pi}}=\frac{s}{S\sqrt{\pi}}.$$

But $\frac{1}{\sqrt{A}}=\frac{s}{S\sqrt{\pi}}$. $\therefore\ \frac{1}{\sqrt{A}}=\frac{1}{\sqrt{A_1}}+\frac{1}{\sqrt{A_2}}+\frac{1}{\sqrt{A_2}}$. Q. E. D.

Also solved by *G. B. M. Zerr*, *P. S. Berg*, *P. H. Philbrick*, *J. R. Baldwin*, and *H. C. Whitaker*.

PROBLEMS.

17. **Proposed by ROBERT J. ALEY, A. M., Professor of Mathematics in the Indiana University, Bloomington, Indiana.**

Draw a circle bisecting the circumferences of three given circles.

18. **Proposed by Professor HENRY HEATON, Atlantic, Iowa.**

Through two given points to draw two circles tangent to a given circle.

19 **Proposed by J. A. CALDERHEAD, Superintendent of Schools, Limaville, Ohio.**

If any point be taken in the circumference of a circle, and lines be drawn from it to the three angles of an inscribed equilateral triangle, prove that the middle line so drawn is equal to the sum of the other two.

20. **Proposed by GEORGE BRUCE HALSTED, A. M., Ph. D., Member of the London Mathematical Society, and Professor of Mathematics in the University of Texas, Austin, Texas.**

Demonstrate by pure spherical geometry that spherical tangents from any point in the produced spherical chord common to two intersecting circles on a sphere are equal.

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